"Bronceado" of beans, an abnormal condition of dry beans (Phaseolus vulgaris L.)

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In the past couple of years, an abnormal condition on dry beans plants has been observed in the central part of Chile (Lat 33° to 38° South). This condition has been termed "bronceado", and there is concern among farmers and seed producers as the presence of these plants and appreciable losses in yield and grain quality are apparently correlated.

Once a microorganism was discarded as the causing agent of this abnormality, a subsequent chemical analysis of soil nutriments and foliar analysis of sympton and symptonless plants was carried out. Soil analyses indicated no difference in mineral content of the different types of soils from where affected plants were collected as compared to those soils in which unaffected plants were obtained. Plants with "bronceado", however, presented abnormally higher levels of manganese and iron than healthy plants, as can be observed in Table 1. These higher levels were consistently found in all organs of the plants, and the highest content was found in the leaves (Table 2). The proportion of iron of the leaves increased with age, but the content of manganese, as is the case with other mineral elements, remained stable (Table 3).

In general, the most conspicuous sympton of the "bronceado" of beans is a necrosis of the margins of the leaves. This peripheral necrosis interferes with normal leaf expansion resulting in spoon-shaped leaves. The center of these leaves usually become chlorotic, then tanned, and finally acquire a light brown color. Plants presenting an advanced stage of necrosis are enterily defoliated but petioles and pods remain attached to the main stems. Occasionally, petioles and stems may present some mottling and light brown stripes on the pods. Beans produced by plants with "bronceado" are usually malformed, shrank, and no fading or change in color has been detected.

Preliminary results indicate that the disorder known as "bronceado" in Chile is apparently not caused by any microorganism as originally thought, and that the causing agent is still unknown. As unusually higher levels of manganeses and iron are found on diseased plants, it is plausible that accumulation of these elements to toxic levels, according to international standars, could be partly responsable of this disorder. The study of the causing agent(s) of the "bronceado" and its effect on beans is underway at the Quilamapu Experiment Station of INIA at Chillán, Chile.

TABLE 1- FOLIAR ANALYSIS OF HEALTHY PLANTS AND PLANTS HAVING "BRONCEADO"(1) 1986.

S I T E	CATEGORY	E L E M E N T S							
		K (%)	Ca (%)	Mg (%)	Zn (ppm)	Cu (ppm)	B (ppm)	Mn (ppm)	Fe(ppm)
1	Normal	1.87	2.1	0.39	27.50	15.0	36.0	62.5	425.0
	Bronceado	1.68	4.5	0.90	45.63	20.0	47.0	500.0	2,375.0
2	Normal	2.21	1.8	0.45	37.50	20.0	23.0	75.0	237.5
	Bronceado	2.84	2.2	0.73	77.50	27.5	37.5	550.0	3,375.0
3	Normal	2.09	1.9	0.29	30.63	12.5	41.0	62.5	250.0
	Bronceado	2.78	2.8	1.01	70.63	25.0	73.5	937.5	4,437.5
4	Normal	1.59	2.8	0.49	30.00	15.0	24.0	75.0	187.5
	Bronceado	2.69	4.1	0.80	55.00	22.5	37.0	687.5	3,125.0
5	Bronceado	2.56	3.5	0.83	56.25	20.0	44.0	600.0	4,000.0
Range* Minnimum			1.40	0.35	42.00	15.0	40.0	75.0	100.0
Maximum				1.30	50.00	20.0	45.0	250.0	800.0

(1): Soil analysis Laboratory, La Platina Experiment Station (INIA-Chile)

* : Fuente: Howeler, R. 1983. Análisis del tejido vegetal en el diagnóstico de problemas nutricionales. CIAT, Cali, Colombia. 28 p.

TABLE 2- AVERAGE CONTENT OF Mn AND Fe OF DIFFERENT ORGANS OF BEAN PLANTS(1)

ORGAN	CATEGORY	CONTENT (ppm)	
		Mn	Fe
Seed	Normal	15	156
	Bronceado	31	344
Stem	Normal	22	209
	Bronceado	233	325
Pods	Normal	25	106
	Bronceado	134	250
Foliage	Normal	69	275
	Bronceado	655	3463

(1): Soil analysis Laboratory, La Platina Experiment Station (INIA-Chile)

TABLE 3- AVERAGE CONTENT OF Mn AND Fe AT DIFFERENT PHENOLOGICAL STAGES OF DRY BEANS(1). 1986.

AGE STAGE	CATEGORY	CONTENT (ppm)	
		Mn	Fe
Bloomy	Normal	62.5	250.0
	Bronceado	937.5	4437.5
Green pod	Normal	85.0	668.0
	Bronceado	776.0	6460.0
Dought stage	Normal	86,0	570,0
	Bronceado	897.0	7235,0

(1) : Soil analysis Laboratory, La Platina Experiment Station (INIA-Chile)